MYCOTAXON

Volume 110, pp. 211–217 *October–December 2009*

A new *Boletus* from North America

Beatriz Ortiz-Santana[1], David P. Lewis[2] & Ernst E. Both[3]

bortizsantana@fs.fed.us
[1]US-Forest Service, Northern Research Station, Center for Forest Mycology Research, One Gifford Pinchot Drive, Madison, Wisconsin 53726-2398 USA

[2]262 CR 3062, Newton, TX 75966-7003 USA

[3]Buffalo Museum of Science 1020 Humboldt Parkway, Buffalo, New York 14211 USA

Abstract — *Boletus roodyi* is described as new to science. It appears to be mycorrhizal with *Quercus* and is widely distributed from central West Virginia to Arkansas and eastern Texas.

Key words — *Boletaceae*, ectomycorrhizal fungi, taxonomy

Introduction

Boletus roodyi sp. nov. is characterized by its blood red to pinkish-purplish red pileus, yellow hymenophore, smooth stipe stained with red, and lack of bluing reaction in any parts. It has a wide, though disjunct, distribution from central West Virginia – from Taylor County in the north to McDowell County in the south – to eastern Arkansas and far eastern Texas close to the border with Louisiana. It is associated with *Quercus* and appears most similar to *Boletus rubissimus* A.H. Sm. 1973 from Michigan, which differs in its smaller basidiospores, apically reticulated stipe, and bluing hymenophore and flesh.

Materials and methods

Macroscopic descriptions are based on fresh and dried specimens, field notes and color photographs. Color terms are approximations, while capitalized color terms in parentheses are from Ridgway (1912). Numerical color designations are from Kornerup & Wanscher (1978). Macrochemical reactions were determined using 10% NH_4OH and 5% KOH. Microscopic structures were observed with an Olympus BH-2 compound microscope; freehand sections of dried fungal material were rehydrated in 70% ETOH and mounted in H_2O, 3% KOH and Melzer's reagent. In the description of basidiospores, *n* = number measured,

followed by the mean spore lengths and widths ± their standard deviations and the Q_m value, which represents the mean Q value ± its standard deviation; Q = mean length/width ratio. Herbarium acronyms are from Holmgren et al. (1990).

Taxonomic description

Boletus roodyi B. Ortiz, D.P. Lewis & Both, **sp. nov.** Figs. 1, 2

MycoBank: 513384

Pileus rubrosanguineus, subtomentosus, siccus, 50–160 mm latus. Contextus albus vel pallide luteus, immutabilis. Tubi flavi, demum olivaceo-viridi, pori concolores, non contusi. Stipe pallide flavus supra, rubro maculates infra medium. Basidiosporae 9.5–16.2 × 3.6–4.5 µm.

Type: W.C. Roody, 27 Aug 1998, Teter Creek Lake, Barbour Co., West Virginia, USA (**Holotype** Both 4499 BUF, Isotype CFMR).

Etymology: in honor of William C. Roody, its discoverer and collector of the holotype, consummate field biologist, mycologist and photographer, author of "Mushrooms of West Virginia and the Central Appalachians" and co-author of three major books on macrofungi of North America.

Icones: NAB-16, NAB-17 (Bessette et al. 2000: 363)

Pileus 50–160 mm broad, convex to plano-convex to plane, in age at times with upturned marginal areas and then plano-concave, when immature with a faint whitish pruina, dry, glabrous to faintly velutinous to subtomentose, becoming rimose-areolate in age; uniformly red, "Dragon's Blood Red" to "Pompeian Red" (9C7), pinkish red to rose red (10C5), or blood red (10C7–8), as dark as "Etruscan Red" (near 9E5 to 10E7) or ruby red (12C-D6); margin at first incurved, becoming decurved, sterile, narrowly projecting, yellow. Flesh very pale yellow to nearly white, with a very narrow red line under the pileipellis, not changing color when exposed or developing reddish stains in some. Odor not distinctive (but strongly cumarinous as dried). Taste mild to slightly astringent. Tubes adnate to narrowly depressed, 5–10 mm long, "Lemon Chrome" (3A5) to pale golden yellow (4A5), becoming more greenish yellow (3A4–5), in age greenish-olivaceous, darkening to yellow-orange when bruised; pores somewhat angular, 1–2 mm broad, concolorous with tubes. Spore Deposit brownish-olivaceous. Stipe 50–110 mm long, 10–25 mm broad, equal most of its length but tapered at the base, glabrous to finely pruinose; pale golden yellow in apical area, paler yellow downward (2A3), irregularly streaked, mottled or flecked red-concolorous with pileus mainly in the lower half of stipe, in some only so at the base; basal mycelium white. Flesh whitish to very pale yellow, golden yellow in larval tunnels, red in the base at times, unchanging when exposed.

Basidiospores 9.5–16.2 × 3.6–4.5 µm (n = 20, 13.26 ± 2.60 × 4.16 ± 0.46; Q_m = 3.17 ± 0.40), fusoid, smooth, with grayish yellow or greenish yellow

Fig. 1. Basidiomata of *Boletus roodyi*, Both 4597 (BUF).

contents in KOH; inamyloid, dextrinoid, or with pale grayish blue contents in Melzer's. Basidia 21.6–26.1 × 6.3–7.2 μm, clavate, (1-2) 4-sterigmate, hyaline or with yellowish contents in KOH, with golden yellow, yellowish brown or dextrinoid contents in Melzer's. Basidioles 14.4–27.9 × 7.2–9 μm, clavate. Pleurocystidia 35.1–53.1 × 7.2–10.8 μm, ventricose-rostrate or fusoid-ventricose, hyaline in KOH, few, smooth and thin-walled. Cheilocystidia 18–36.9 (41.4) × 5.4–10 μm, versiform, fusoid-ventricose, fusoid, fusoid-mucronate or clavate, occasionally one-septate, hyaline or with yellow or yellowish brown contents in KOH, smooth and thin-walled. Pileipellis a tangled layer of repent hyphae 2.7–5.9 μm broad, contents coral red in H_2O, becoming yellow to grayish yellow in KOH; grayish yellow to yellowish brown in Melzer's; end cells cylindrical. Pileus trama hyphae moderately loosely interwoven, 4–9 μm broad, hyaline in KOH, yellowish brown to dextrinoid in Melzer's, smooth, thin-walled. Hymenophoral trama boletoid, divergent, grayish yellow in KOH; yellow, golden yellow or yellowish brown in Melzer's, in mass occasionally with a fleeting amyloid reaction; lateral strata elements 2.7–5.4 μm broad, loose; mediostratum 18–36 μm wide, parallel hyphae 4.5–15.3 μm broad. Stipitipellis hyphae 3.6–16.2 μm broad, subparallel to interwoven, hyaline in KOH, orange yellow to dextrinoid in Melzer's.

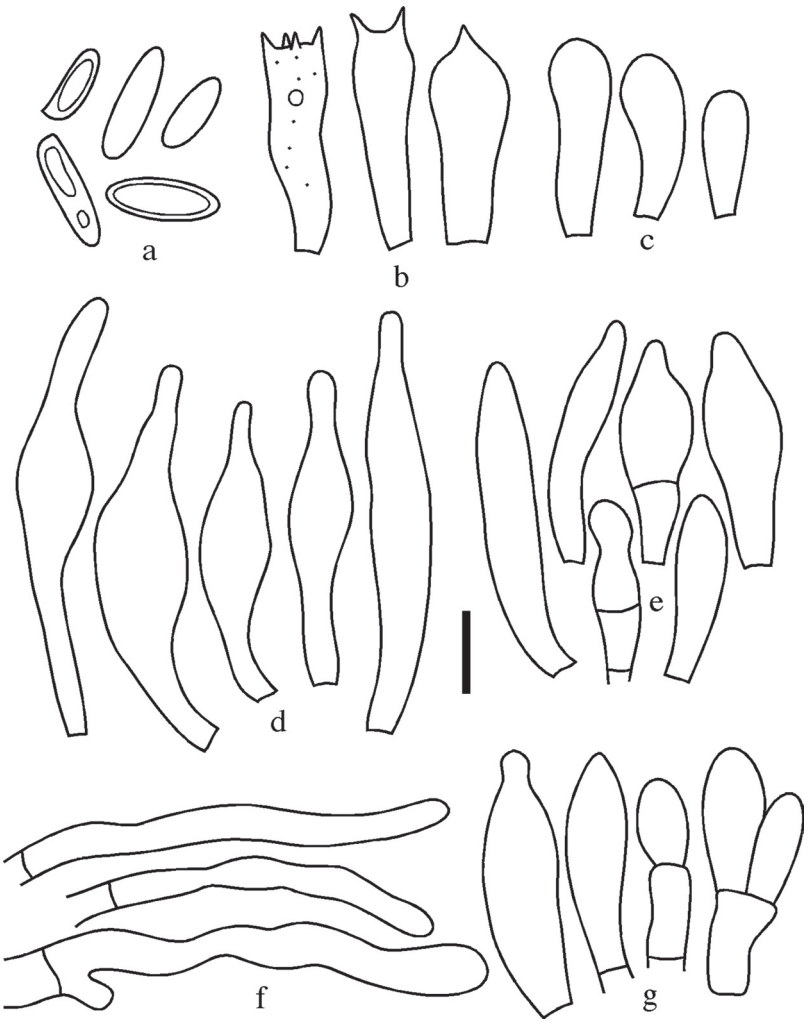

Fig. 2. Microscopic features of *Boletus roodyi*, HOLOTYPE, Both 4499 (BUF). a. Basidiospores. b. Basidia. c. Basidioles. d. Pleurocystidia. e. Cheilocystidia. f. Elements of the pileipellis. g. Caulocystidia. Scale bar = 10 µm.

Caulocystidia 16.7–31.5 × 5.4–9 µm, clavate, occasionally with a mucronate or capitulate apex, in clusters (fasciculate), hyaline in KOH, with yellow or golden yellow contents in Melzer's, thin-walled. Clamp connections absent.

Macrochemical reactions: NH_4OH and KOH on pileus surface produce a slate-blue flash that quickly changes to yellow ocher. KOH on context pale bluish, on tubes bluish green fading to a lighter shade; on stipe surface NH_4OH

and KOH dingy amber; NH_4OH on dried pileus surface dark red, bleaching to very pale pink.

Ecology, range, and distribution: Gregarious to scattered, rarely caespitose, with various species of oak (*Quercus alba*, *Q. coccinea*, *Q. rubra* in West Virginia; *Q. alba*, *Q. michauxii*, *Q. nigra* in Texas), in mixed woods of oak and pine (*Pinus strobus, P. taeda*), or oak, hickory and beech; from central West Virginia to eastern Arkansas and eastern Texas; fruiting from late June to mid-September.

Additional material examined: **USA**. **Arkansas**: **Perry Co**. Lake Sylvia Campground, 16 Jul 2005, D.P. Lewis (*Lewis 7265*) (BUF, CFMR). **West Virginia**: **Barbour Co**. Teter Creek Lake 10 Aug 2001, W.C. Roody (*Both 4548*) (BUF, CFMR); 4 Jul 2004, D. Mitchell (*Both 4598*) (BUF); **McDowell Co**. Panther State Forest, 22 Jul 2002, W.C. Roody, (*Both 4597*) (BUF). **Texas: Hardin Co**. Big Thicket National Preserve, Jack Gore Bayall Unit, 26 Jul 1985, D.P. Lewis (*Lewis 3882*) (F); 19 Sep l987, D.P. Lewis (*Lewis 4075*) (F); **Newton Co**. Bleakwood, grounds of Lewis residence, 262 CR 3062 and State Highway 87, 25 June 2000, D.P. Lewis (*Lewis 6296*) (BUF, F); 1 Jul 1996, D.P. Lewis (*Lewis 5675*) (F); 22 June 2003, D.P. Lewis (*Lewis 6696*) (BUF, CFMR); **Orange Co**. Vidor, grounds of Our Lady of Lourdes Catholic Church, off FM105, 29 June 1982, D.P. Lewis *(Lewis 3113)* (SFSU); **Tyler Co**. Big Thicket National Preserve, Beech Creek Unit, 1 Jul 1982, D.P. Lewis (*Lewis 3147*) (F); 14 Jul 2006, D.P. Lewis (*Lewis 7525*) (BUF). Ten collections from nine counties in West Virginia were deposited by W.C. Roody in the Davis Elkins College Herbarium (DEWV). These were not examined by the authors but are assumed to be conspecific.

Commentary: In their section "Undescribed Bolete Species," Bessette et al. (2000) provided two views of a group of three specimens of *Boletus roodyi* (as NAB 16 and NAB 17), stating that "this species appears to be a member of the *Boletus speciosus* or *Boletus regius* group and seems closest to *Boletus rubissimus* Smith." Indeed, Smith (1973) placed *B. rubissimus* in stirps *Regius* of *Boletus* and compared it with *B. peckii* Frost 1878, *B. pseudopeckii* A.H. Sm. & Thiers 1971, *B. regius* Krombh. 1832, and *B. speciosus* Frost 1874, exactly where Singer (1977) placed it (in his section *Appendiculati),* but without including *B. peckii,* which he placed in section *Calopodes* because of its bitter taste. While *Boletus roodyi* shares overall colors with *B. rubissimus*, it differs in the lack of a reticulum, the non-bluing context, the white (instead of yellow) mycelium around the base of the stipe and the larger spores (9–16.5 × 3.6–4.5 vs. 9–11 × 3–4 μm).

The lack of any bluing or reticulum, the adnate (to narrowly depressed) tubes, and the pruinosity of at least the immature stage would place *B. roodyi* in section *Subpruinosi* in Singer's (1986) classification and where Peck (1900) placed his *Boletus roseotinctus* from North Carolina, a species that has not been reported since. The description by Peck could easily apply to *Boletus roodyi*: "Pileus broadly convex to nearly plane, firm, dry, pruinose, pink or pale rosy red, flesh yellowish white; tubes short, adnate, yellowish, their mouths minute, subround, the dissepiments even, stem equal, even, yellow above, red or purple

red below; spores oblong, 10–12 × 4–5 µm, pileus about 5 cm broad, July and August." Snell (1934), who examined Peck's material at Albany, noted "that there were specimens there larger than the dimensions given by Peck" and believed that he had collected it but did not provide any details. Murrill (1909) and Coker & Beers (1943) treated *B. roseotinctus* as a synonym of *B. peckii,* but Snell (1934) disagreed with Murrill's disposition since *B. peckii* was "characterized by a reticulate stipe and whitish flesh changing to blue, while *B. roseotinctus* has an even, furfuraceous stipe and unchanging flesh. Unfortunately, the type of *Boletus roseotinctus* appears to be lost and no other collections are known to exist (Both 1993).

Boletus roodyi also bears some resemblance to *Boletus bicolor* Peck 1872 and its relatives in Stirps *Sensibilis* of *Boletus,* Subsection *Fraterni* in the classification of Smith & Thiers (1971). Among these are the red colors of the pileus, the yellow stipe with red tones, and the short tubes. However, *B. roodyi* differs in the lack of any bluing reaction and in the stable red pigments of its pileus. The red pigment in the pilei of *B. bicolor, B. miniato-olivaceus* Frost 1874, and *B. carminipes* A.H. Sm. & Thiers 1973 appears to be unstable since it gradually pales with age being replaced by yellow to olivaceous tones.

The single collection of *B. roodyi* from Arkansas of four caespitose specimens is very similar to collections from West Virginia, but the stipes are nearly entirely pale yellow except for the very base which is red. The collections from Texas are more slender and the pilei have more vinaceous red colors, while the red stains on the stipes are more irregular and not primarily confined to the lower half of the stipe.

Acknowledgements

We thank William Roody for providing field notes, photographs, and specimens. We are grateful to Drs. Manfred Binder and Todd Osmundson for their review of this manuscript.

Literature cited

Bessette AE, Roody WC, Bessette AR. 2000. North American boletes: a color guide to the fleshy pore mushrooms. Syracuse University Press, USA.

Both EE. 1993. The boletes of North America. A compendium. Buffalo Museum of Science. Buffalo, New York, USA.

Coker WC, Beers AH. 1943. The Boletaceae of North Carolina. University of North Carolina Press, Chapel Hill, USA.

Holmgren PK, Holmgren NH, Barner, LC. 1990. Index Herbariorum, part I: the herbaria of the world. Reg Veg 120: 1–693. http://sweetgum.nybg.org/ih/.

Kornerup A, Wanscher JH. 1978. Methuen handbook of colour. 3rd ed., reprinted. Eyre Methuen Ltd., London. 252 pp.

Murrill WA. 1909.The *Boletaceae* of North America-II. Mycologia 1: 140–160.

Peck CH. 1900. New species of fungi. Bull.Torrey Bot. Club 27: 609–613.

Ridgway R. 1912. Color standards and color nomenclature. Washington, D.C. Published by the author. 53 color plates.

Singer R. 1977. Key for the identification of the species of *Agaricales* I. Sydowia 30: 92–279.

Singer R. 1986. The *Agaricales* in modern taxonomy. 4th ed. Koeltz Scientific Books, Koenigstein (Germany).

Smith AH. 1973. Notes on Michigan *Boletaceae.* Persoonia 7(2): 321–331.

Smith AH, Thiers HD. 1971. The boletes of Michigan. University of Michigan Press, Ann Arbor, USA.

Snell WH. 1934. Notes on boletes III. Mycologia 26: 348–359.